

Power
Steam Turbines

To: Adrian Bramley
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cc: Phil Kearney/ File

From: Joyce Moore
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Date: 24th July 2002

Subject: Intermountain- HP heaters out of service

In response to James Nelson's e-mail (dated 12th July 2002), regarding the ability of the Intermountain turbines to tolerate short term operation with HP heaters isolated, a variety of scenarios were assessed. These scenarios were as follows:

- 1) One HP heater string isolated
- 2) All 6 HP heaters isolated
- 3) One top HP heater (e.g. heater 8b) isolated
- 4) Both top HP heaters isolated
- 5) One HP 7 heater isolated
- 6) Both HP 7 heaters isolated
- 7) One HP 6 heater isolated
- 8) Both HP 6 heaters isolated

In addition to determining the LP turbine exhaust flow under these conditions (as was requested), the heater pressures on the steam side of all heaters and the IP exhaust pressure were calculated. The heater pressures were then checked against the design pressures.

The IP exhaust pressure gives an indication of the loading on the latter stages of the IP turbine as well as on the LP turbine stages. This pressure was compared to that given by the predicted performance of the cycle with VWO (see drawing no. TS29247). From Test 8 carried out by PGT in April 2002, it can be seen that the turbines have been run under conditions very similar to those shown on TS29247. This shows the ability of the turbines to tolerate these conditions, although the IP exhaust pressure achieved (137.2 psia) is higher than that previously indicated on the OEM 5% O/P heat balance diagram. (Note: Units 1 & 2 turbines have previously operated at very similar pressure levels during BMCR tests in 1998)

The results showed that under all conditions, the LP exhaust loading was below the design limit of 15,000 lb/ft² per exhaust. Heater pressures also fell within design with

MEMORANDUM

Power

Steam Turbines

the exception of the deaerator exceeding its design limit when all 6 HP heaters were isolated at throttle valves wide open (VWO). In all scenarios at VWO however, the IP exhaust pressure exceeded 137.2 psia. Further calculations were carried out in order to find the power output to which the turbines must be limited in order to reduce the IP exhaust pressure a value of 137.2 psia (the maximum normal operating pressure with all heaters in service- subject to review by IPSC/GE).

As a result of the analysis, it is advised that the generator output should be limited to the following when any of the HP heaters are tripped:

1) One HP heater string isolated	923MW
2) All 6 HP heaters isolated	870MW
3) One top HP heater isolated	956MW
4) Both top HP heaters isolated	942MW
5) One HP 7 heater isolated	962MW
6) Both HP 7 heaters isolated	952MW
7) One HP 6 heater isolated	969MW
8) Both HP 6 heaters isolated	965MW

In order to operate at higher loads, it is recommended that IPSC contact GE in order to obtain the maximum allowable conditions for safe operation of the IP and LP turbines.

Joyce Moore

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Intermountain Units 1 and 2
Results of Heat Balance with HP Heaters Isolated

Comparison of pressures with HP heaters isolated

Heater No.	Pressure (psia)	VWO	Throttling	One HP Heater Isolated		Two HP Heaters Isolated		Three HP Heaters Isolated		Four HP Heaters Isolated		Five HP Heaters Isolated		Six HP Heaters Isolated		Seven HP Heaters Isolated	
				VWO	Throttling	VWO	Throttling	VWO	Throttling	VWO	Throttling	VWO	Throttling	VWO	Throttling	VWO	Throttling
1	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8
2	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8
3	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8
4	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8
5 (exhaust)	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8
HP Exhaust Pressure	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8
6	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8
7	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8
8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8

Isolated heater (2) assumed vented

257.6

Comparison of flow/power output/heat added with HP heaters isolated

Parameter	Unit	VWO	Throttling	One HP Heater Isolated		Two HP Heaters Isolated		Three HP Heaters Isolated		Four HP Heaters Isolated		Five HP Heaters Isolated		Six HP Heaters Isolated		Seven HP Heaters Isolated	
		VWO	Throttling	VWO	Throttling	VWO	Throttling	VWO	Throttling	VWO	Throttling	VWO	Throttling	VWO	Throttling	VWO	Throttling
Throttle Flow (Mlb/h)		6.805	6.738	6.666	6.598	6.525	6.458	6.387	6.310	6.238	6.164	6.093	6.027	5.959	5.892	5.828	5.769
Power Output (MW)		1015	1000	985	970	955	940	925	910	895	880	865	850	835	820	805	790
Heat Added (MW)		2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.0	0.9	0.8	0.7	0.6
Percentage change of heat added																	

Flow through each exhaust of LP turbine

Parameter	Unit	VWO	Throttling	One HP Heater Isolated		Two HP Heaters Isolated		Three HP Heaters Isolated		Four HP Heaters Isolated		Five HP Heaters Isolated		Six HP Heaters Isolated		Seven HP Heaters Isolated	
		VWO	Throttling	VWO	Throttling	VWO	Throttling	VWO	Throttling	VWO	Throttling	VWO	Throttling	VWO	Throttling	VWO	Throttling
Exhaust Flow (Mlb/h)		1277	1277	1277	1277	1277	1277	1277	1277	1277	1277	1277	1277	1277	1277	1277	1277
Exhaust Pressure (psia)		1277	1277	1277	1277	1277	1277	1277	1277	1277	1277	1277	1277	1277	1277	1277	1277

2nd July 2002 JH